UNITED STATES BANKRUPTCY COURT
SOUTHERN DISTRICT OF NEW YORK

In re	:	Chapter 11
DELPHI CORPORATION, et al.,	:	Case No. 05-44481 (RDD)
	:	(Jointly Administered)
Debtors.	:	

EXHIBIT C

TO

RESPONSE OF ROBERT BOSCH GmbH TO DEBTORS' THIRD OMNIBUS OBJECTION TO CLAIMS

§1 Scope of EP434679 B1 Apparatus and method for tripping a system for the protection of occupants of a vehicle

Today vehicles contain a safety system to protect the passengers in case of a severe collision, e.g. by actuating an airbag or tensioning a seat belt. In order to activate the airbag, one or more acceleration sensors measure the severity of the collision, thus providing a signal proportional to the severity of the collision. If the acceleration sensors have their main sensitivity only in one direction, namely in the direction of motion of the car, oblique collisions or side collisions will usually give rise to a lower signal than collisions from the front would do. As a consequence, the safety system might be activated too late.

§ 2 Solution claimed:

By introducing a second sensor measuring the acceleration at an angle to the first sensor, signals can be generated which are better adopted to side or oblique collisions. By combining both the signal of the first and the signal of the second sensor, one can determine which kind of collision is concerned at present - front, oblique or side collision. It is advantageous in respect of production costs to locate both sensors in a centralised unit, e.g. the sensing and diagnostic module. This apparatus can be described as:

a) Apparatus for tripping a system for the protection of occupants of a vehicle,
b) with a first sensor for sensing the acceleration of the vehicle along a first axis, in the direction of forward motion of the vehicle, and
c) with a second sensor for sensing the acceleration of the vehicle along a second axis, inclined to the first axis,and
d) a control means, responsive to signals from the first and second sensors, the occupant protection system being triggered by said control means in dependence upon the signals from the first and second sensors, characterised in that
e) both the said first sensor and the said second sensor are arranged in a centralized unit.

§ 3 Indications of infringement by Delphi products

Delphi supplies several car makers, e.g. GM, with sensing and diagnostic modules (SDM) for automotive restraint systems. We investigated exemplarily the following Delphi-SDMs:

SDM number	**car**
GM#12208170	Chevrolet Monte Carlo
GM#12249609	Chevrolet Tahoe
GM#12240200	Chevrolet Blazer
GM#12249549	GMC Canyon
GM#12241730	Chevrolet Impala
GM#12231830	GMC Savana
GM#90512128	Opel Vectra
GM#12798517	Saab

In the investigated SDMs from Delphi there are two acceleration sensors made by Analog Devices, Inc integrated into one housing. These two acceleration sensors will sense the acceleration of the vehicle along a first axis, in the direction of forward motion of the vehicle, and will sense the acceleration of the vehicle along a second axis, inclined to the first axis. The two acceleration sensors are arranged on the printed circuit board in the SDM, the SDM is arranged on the tunnel between driver and passenger. In other words the two acceleration sensors are arranged in a centralized unit.

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 434 679 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication of patent specification: **12.05.93** (51) Int. Cl.5: **B60R 21/32**, G01P 15/00

(21) Application number: **88908209.5**

(22) Date of filing: **17.09.88**

(86) International application number:
PCT/EP88/00850

(87) International publication number:
WO 90/03289 (05.04.90 90/08)

(54) APPARATUS FOR TRIPPING A SYSTEM FOR THE PROTECTION OF OCCUPANTS OF A VEHICLE.

(43) Date of publication of application:
03.07.91 Bulletin 91/27

(45) Publication of the grant of the patent:
12.05.93 Bulletin 93/19

(84) Designated Contracting States:
DE GB SE

(56) References cited:
EP-A- 0 419 455
FR-A- 2 541 775
US-A- 3 851 305
US-A- 3 911 391

(73) Proprietor: **ROBERT BOSCH GMBH**
Postfach 30 02 20
W-7000 Stuttgart 30(DE)

(72) Inventor: **JEENICKE, Edmund**
Stuttgarter Stra e 102
W-7141 Schwieberdingen(DE)
Inventor: **MATTES, Bernhard**
Querstra e 41
W-7123 Sachsenheim(DE)
Inventor: **CODNE, Claus**
Wadgasser Stra e 65
W-6633 Wadgassen(DE)
Inventor: **HENNE, Michael**
Schlo Stra e 24
W-7257 Ditzingen-Schöckingen(DE)

EP 0 434 679 B1

Description

State of the Art

The present invention relates to an apparatus of the kind described in the first part of claim 1.

In known vehicle occupant restraining devices, such as inflatable airbags, the devices are actuated when the acceleration of the vehicle, as measured by an accelerometer, is above a certain value which indicates that the vehicle has crashed. However, the known sensor systems often actuate the restraining devices too late if the impact is oblique (e.g. 30°) or if the impact is a slow offset crash. This is due mainly to the greatly differing energy-absorbtion behaviour of vehicles having a crumple zone in the case of frontal and oblique impacts.

Known systems for determining the acceleration of the vehicle are either in the form of a central sensor system or in the form of a plurality of decentralised sensors. However, in both cases, the acceleration signal is measured only in the longitudinal direction of motion of the vehicle, resulting in problems in actuating the occupant restraining device when a significant acceleration is experienced along an axis other than the longitudinal direction of motion of the vehicle. A plurality of decentralized sensors requires high installation costs. Above all such a system is vulnerable to damages of the cable strands.

In US-A-3851 305 column 8, lines 14-23 an electric collision detecting system is described wherein a collision detector is provided for producing a collision signal when an object contacts the motor vehicle, and wherein a deceleration detector is provided for producing a real deceleration signal. Both detector tees are arranged apart from each other in the front part of the vehicle.

In the earlier European application 88905370,8 (EP-A-0 419 455) an apparatus for tripping a system for the protection of occupants of a vehicle according to the first part of claim 1 is disclosed.

It is an object of the present invention to provide an apparatus for triggering vehicle occupant restraining devices which will be effective in actuating the devices even if an impact on the vehicle is not a frontal impact and which results in lower installation costs.

This is achieved by adopting the features set forth in claim 1.

Further advantages are obtained by the features of claim 2.

Drawings

By way of example only, specific embodiments of the present invention will now be described, with reference to the accompanying drawings, in which:-

Fig. 1 is a diagrammatic representation of a first embodiment of a triggering apparatus for an inflatable airbag, in accordance with the present invention;

Fig. 2 is a diagrammatic representation of a second embodiment of a triggering apparatus for an inflatable airbag, in accordance with the present invention;

Fig. 3 is a diagrammatic representation of a third embodiment of a triggering apparatus for an inflatable airbag, in accordance with the present invention; and

Fig. 4 is a diagrammatic representation of a fourth embodiment of a triggering apparatus for an inflatable airbag, in accordance with the present invention.

Description of the Exemplary Embodiments

Referring firstly to the first embodiment, illustrated in Fig. 1, the apparatus comprises a sensor 10 for detecting the acceleration of a vehicle along an axis parallel to the forward direction of motion of the vehicle (hereinafter referred to as the longitudinal direction), and a sensor 12 for detecting the acceleration of the vehicle along an axis inclined at right angles to the longitudinal axis (hereinafter referred to as the transverse direction). The longitudinal acceleration sensor and the transverse acceleration sensor feed signals a_x and a_y to respective evaluation devices 14, 16. The evaluation devices 14, 16 may, for example, be in the form of electronic integrators.

If the evaluation means 14 determines that the longitudinal acceleration is greater than a predetermined threshold value then the evaluation means 14 sends a signal b to an output stage 18 which is in the form of a transistor switch. The output stage is effectively an electrical or electronic switch actuated by the signal b, and sends a further signal c which actuates actuation capsules 20, the present example being for the case of an inflatable restraining bag.

It will be noted from Fig. 1 that the output of the evaluation means 16 relating to the transverse acceleration is fed into the evaluation means 14 relating to the longitudinal acceleration. The signal from the evaluation means relating to the transverse acceleration is used to change the evaluation algorithm of the evaluation means 14 relating to the longitudinal acceleration. In this way, even if the longitudinal acceleration sensed is not above the threshold value for actuating the actuation capsules, the evaluation means 14 may determine, upon receipt of the signal from the evaluation means 16, that the overall acceleration of the ve-

hicle is sufficient for the actuation capsule to be actuated, even though neither of the longitudinal and transverse accelerations would, by themselves, be sufficient to do so. It is also useful when, because of the nature of the impact of the vehicle, such as an oblique impact, the eventual acceleration would be sufficient in one direction for the actuation capsules to be actuated, but only after a delay. The present invention reduces the said delay considerably.

The second embodiment, illustrated in Fig. 2, has the same components as the first embodiment, illustrated in Fig. 1. However, the signal a_x from the longitudinal acceleration sensor 10 is also sent to the transverse evaluation means 16, in addition to the longitudinal evaluation means 14.

As before, the longitudinal acceleration still forms the basis of calculating whether the actuation capsules 20 are to be actuated. However, the two signals a_x and a_y from the longitudinal and transverse acceleration sensors 10, 12 are processed together in the transverse evaluation means 16. In this way, the overall magnitude and direction of the acceleration of the vehicle can be determined, and the output of the evaluation means 16 can be used to change the actuation parameters of the longitudinal evaluation means 14. For example, even if the longitudinal acceleration a_x is not sufficient for the evaluation means 14 to actuate the actuation capsules 20, then, depending on the signal from the evaluation means 16, the evaluation means 14 may still send a signal b to the output stage 18, which in turn actuates the actuation capsules by virtue of a signal c.

The second embodiment thus permits actuation of the actuation capsules in certain predetermined conditions.

The third embodiment, illustrated in Fig. 3, is provided with longitudinal and transverse acceleration sensors 10, 12. Two evaluation channels, channel 1 and channel 2, are provided, and the outputs a_x, a_y from the sensors 10, 12 are fed into each of the evaluation channels 1 and 2. The channels and 2 may comprise, for example, components 14 and 16 of Fig. 1 or Fig. 2, and operate in the same way as described in the first and second embodiments respectively, described above. Each channel 1 and 2 can then determine, independently of the other channel, whether the components of the acceleration of the vehicle reach the predetermined threshold values, and in the case of a positive response, each channel outputs a signal d. The output from channel 1 is fed into a test switch 22, whereas the output of channel 2 is fed into an output stage 18', which has a similar function to the output stage 18 of the first and second embodiments, but which has four outputs for providing an actuating signal c to each of four actuation capsules 20, illustrated schematically. The test switch 22 is a further output stage, and in this particular embodiment is identical to output stage 18', or any other transistor switch. The actuation capsules are connected between the output stage 18' and the test switch 22. This arrangement means that the actuation capsules 20 may only be actuated if a signal is received from both of the channels, 1 and 2. This guards against possible mis-evaluation in one of the channels, since the capsules are actuated only if both channels determine that the conditions of acceleration for actuation of the capsules have been met.

The fourth embodiment, illustrated in Fig. 4, also has longitudinal and transverse acceleration sensors 10, 12. The acceleration signals a_x and a_y are fed to respective integrators 24, 26. The integrated signal from a_x is then fed directly to evaluation means 28 which determines whether the signal from the integrator 24 is above the predetermined threshold value. If this is indeed the case, i.e. that the longitudinal acceleration is such that the restraining means should be used, the evaluation means 28 feeds a signal b to an output stage 30, which in turn feeds an actuating signal c to the or each actuation capsule 20.

The integrated signals from the integrators 24, 26 are also fed to a second evaluation means 32. Depending upon the relative magnitudes of the two signals, the magnitude and the direction of the acceleration of the vehicle can be determined, and if they are such as to exceed the predetermined threshold values of the second evaluation means 32 (i.e. they are of such relative strengths that an impact which requires actuation of the safety means has occurred) a signal A is output, and fed into the first evaluation means 28, which, as previously, acts to actuate the actuation capsules 20.

The output signals of the integrators 24, 26 are also each fed to a further respective integrator 34, 36, and the output of the further integrators 34, 36 are fed into a third evaluation means 38. If the relative values of the two doubly-integrated signals exceed the predetermined values (which indicate that an impact requiring the actuation of the restraining device is required) then a signal B is output from the evaluation means 38 and input into the first evaluation means 28. The first evaluation means 28 then acts to actuate the actuation capsules 20.

Thus, the fourth embodiment can act to actuate the actuation capsules where the longitudinal acceleration by itself would not be sufficient to trip the actuation, but where the overall acceleration requires that tripping should occur. It is also most beneficial in the case where the longitudinal acceleration would eventually be sufficient to trip the actuation capsules, but only after a delay. This

embodiment often allows earlier tripping of the actuation capsules, especially where an oblique impact is involved.

The present invention has the advantage that, compared with decentralised sensors, the arrangement of the sensors in a centralised unit results in lower installation costs and less risk caused by damage to cable strands. The invention is also particularly suitable for adapting existing vehicles, as opposed to fitting the system in a new vehicle, during construction.

The present invention has been described mainly with reference to actuation of an air bag, but it should be appreciated that it can equally well be applied to other safety systems. For example, the signals b or c from the output stages may be used to tighten safety belts and/or actuate a central door locking system and/or actuate a flashing warning light system .

The present invention also has the advantage that separate additional functions can be controlled by all round detection of acceleration. For example, central locking and flashing warning systems might have all round sensitivity, i.e. may be actuated when the acceleration in any direction exceeds a predetermined value, an airbag might only be activated in the case of the frontal acceleration component reaching a threshold value, whereas belt tightness and central belt locking might be activated in an all round sensitive manner, depending on the wishes of the vehicle owner.

The second sensor need not detect acceleration in the transverse direction, but may, for example, detect acceleration in a direction other than at right angles to the direction of forward motion. For example, the sensor 12 may be adapted to detect acceleration in a direction of oblique impact, e.g. 30 degrees to the direction of forward motion.

Claims

1. Apparatus for tripping a system for the protection of occupants of a vehicle, with a first sensor (10) for sensing the acceleration of the vehicle along a first axis, in the direction of forward motion of the vehicle, and with a second sensor (12) for sensing the acceleration of the vehicle along a second axis, inclined to the first axis, and a control means (14,16), responsive to signals from the first and second sensors, the occupant protection system being triggered by said control means in dependence upon the signals from the first and second sensors, characterised in that both the said first sensor (10) and the said second sensor (12) are arranged in a centralized unit.

2. Apparatus as claimed in claim 1, wherein the first and second sensors (10,12) are arranged to detect acceleration in two mutually perpendicular directions.

Patentansprüche

1. Vorrichtung für die Auslösung eines Systems zum Schutz von Fahrzeuginsassen, mit einem ersten Sensor (10) zum Erfassen der Beschleunigung des Fahrzeugs entlang einer ersten Achse in Richtung der Vorwärtsbewegung des Fahrzeugs, und mit einem zweiten Sensor (12) zum Erfassen der Beschleunigung des Fahrzeugs entlang einer zweiten Achse, die in bezug auf die erste Achse geneigt ist, und mit Auswertemitteln (14, 16), die auf Signale des ersten und des zweiten Sensors reagieren, wobei das Fahrzeuginsassensicherungssystem durch die vorgenannten Auswertemittel in Abhängigkeit von den Signalen des ersten und zweiten Sensors aktiviert wird, dadurch gekennzeichnet, daß der erste Sensor (10) und der zweite Sensor (12) in einer zentralen Einrichtung angeordnet sind.

2. Vorrichtung nach Anspruch 1, in der der erste und zweite Sensor (10, 12) derart angeordnet sind, um Beschleunigungen aus zwei zueinander senkrechten Richtungen zu erfassen.

Revendications

1. Appareil de déclenchement d'un système de protection des occupants d'un véhicule comprenant un premier détecteur (10) de l'accélération du véhicule selon un premier axe ayant la direction de la marche en avant du véhicule, un second détecteur (12) de l'accélération du véhicule selon un second axe, incliné par rapport au premier, ainsi que des moyens de contrôle (14, 16) sensibles aux signaux du premier et du second détecteur, le système de protection des occupants étant déclenché par les moyens de contrôle à partir des signaux reçus du premier et du second détecteur, caractérisé en ce que ces deux détecteurs (10) et (12) sont montés dans une unité de traitement centralisée.

2. Appareil selon la revendication 1, caractérisé en ce que le premier et le second détecteur (10, 12) sont disposés de manière à détecter les accélérations selon deux directions perpendiculaires réciproques.

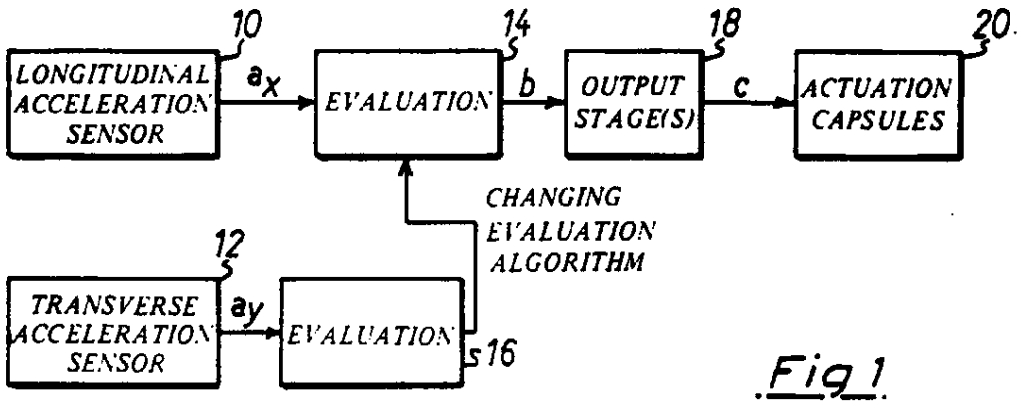

Fig 1

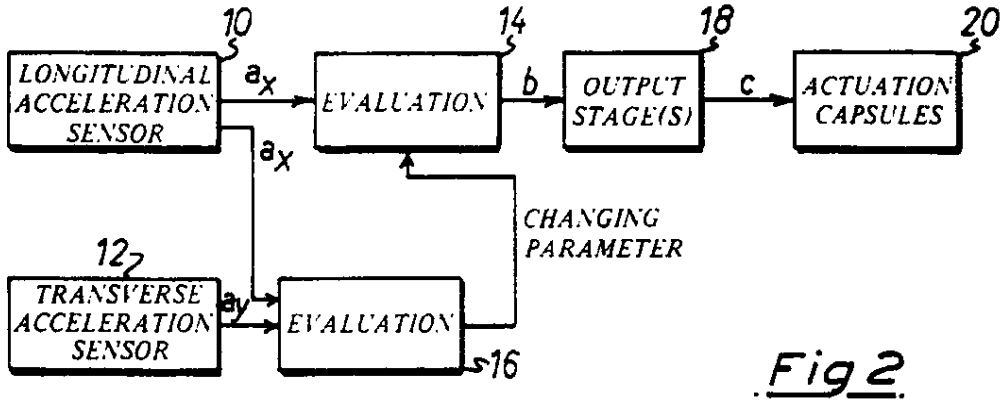

Fig 2

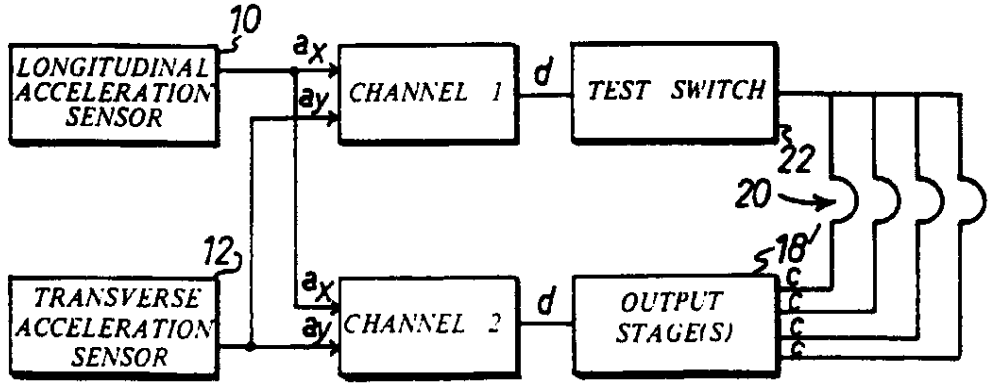

Fig 3

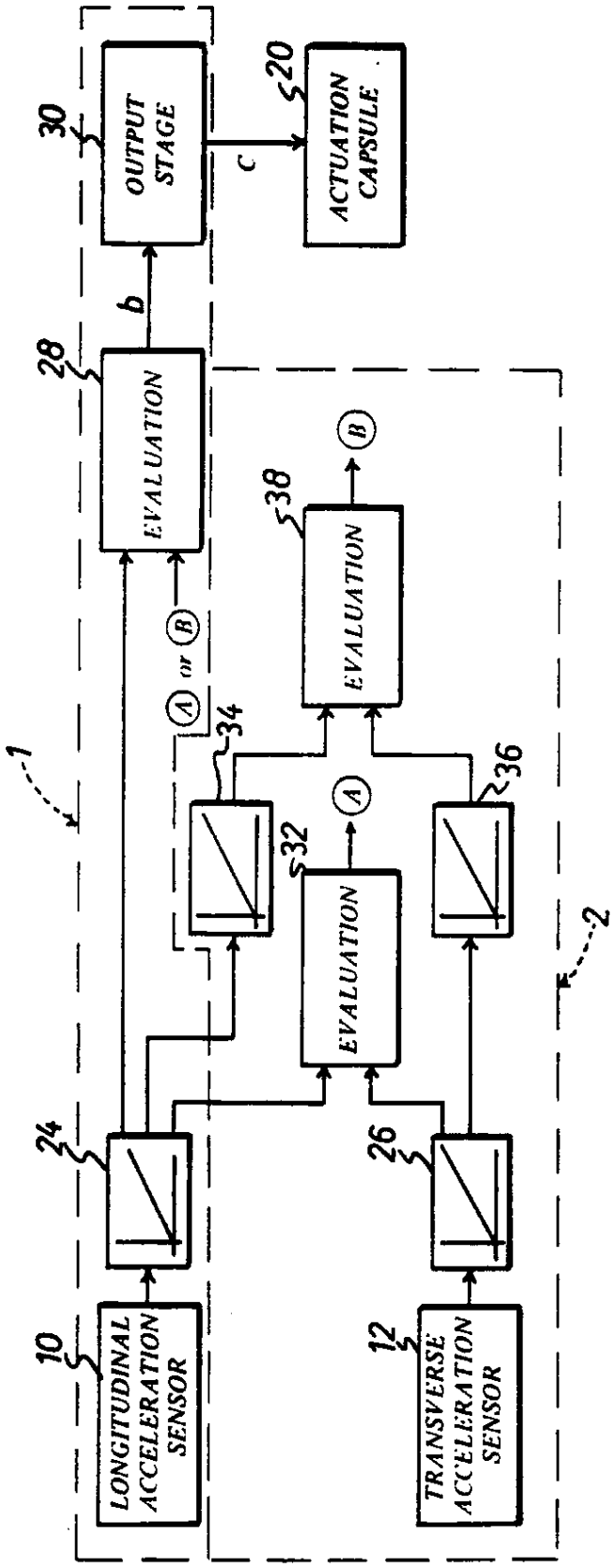
OUTPUT STAGE
30
ACTUATION CAPSULE
20
C
b
EVALUATION
28
A or B
EVALUATION
38
B
34
36
A
EVALUATION
32
1
2
24
26
LONGITUDINAL ACCELERATION SENSOR
10
TRANSVERSE ACCELERATION SENSOR
12

Fig 4.